electroprocessed material that has magnetic or electrical properties and insulin can be fabricated and placed subdermally in an inconspicuous site. By passing a magnetic field or an electrical field across the composition, insulin release can be induced. A similar strategy may be used to release compounds from a construct that has light sensitive elements, exposing these materials to light will either cause the material itself to breakdown and or cause the release of substances that are bound to the electroprocessed material by the light sensitive moiety.

In other embodiments, the substances comprise vesicles encapsulated within the electroprocessed material along with electrical or magnetic materials. The vesicles contain a compound to be released from the vesicles. Placing an electrical or magnetic field across the electroprocessed material causes the compounds within the vesicles can be released by, for example, deforming the vesicles to the point of rupture or by changing the permeability (in some cases reversibly) of the vesicle wall. Examples of these embodiments include transfection agents, such as liposomes, that contain nucleic acids that enhance the efficiency of the process of gene delivery to the cell.

In other embodiments, the composition comprising an electroprocessed material and substance is used as a transdermal patch for localized delivery of medication, or of a component of such a patch. In some of these embodiments, electrically conductive materials are incorporated into such a composition, which is then used as a component of an iontophoresis system in which one or more substances is delivered in response to the passage of electric current. Electrically conductive materials can have a direct healing effect on bone injuries. For example placing a small electric current across a fracture site promotes healing. An electroprocessed bone mimetic that conducts or produces current can be made and placed within a fracture. The addition of the electrical current will promote healing at a rate that is faster than the addition of the electroprocessed composition alone.

In other embodiments, an electroprocessed material or a portion thereof containing electromagnetic properties is stimulated by exposure to a magnet to move and thereby to apply or to release physical pressure to a pressure-sensitive capsule or other enclosure that contains molecules to be released from the material. Depending on the embodiment, the movement will affect the release relate of the encapsulated molecules.

Response of the composition to electric and magnetic fields can be regulated by features such as the composition of the electroprocessed material, size of the filaments, and the amount of conductive material added. Electromechanical response from polyaniline is the result of doping-induced volume changes, whereas ion gradients leading osmotic pressure gradients are responsible for field-induced deformation in ionic gels such as poly(2-acrylamido-2-methyl propanesulfonicacid). In each case, ion transport kinetics dominates the response, and facile transport is observed with the small fibers. Gel swelling and shrinking kinetics have been shown to be proportional to the square of the diameter of a gel fiber. Electromechanical response times of fiber bundles of less than 0.1s, are possible in the regime of typical muscle.

Embodiments involving delivery of molecules produced by cells provide many means by which rejection and immune response to cells can be avoided. Embodiments using cells from a recipient thus avoid the problems associated with rejection and inflammatory and immunological response to the cells. In embodiments in which cells from an organism other than the recipient are used, the matrix can sequester the cells from immune surveillance by the recipient's immune system. By controlling parameters such as the pore size of the electroprocessed material or matrix, nutritive support to the cells trapped in the matrix can be permitted while the cells are protected from detection and response by the recipient's immune system. As an example, pancreatic islet cells that manufacture insulin collected from a donor can be encapsulated in an electroprocessed matrix and implanted in a recipient who cannot make insulin. Such an implant can be placed, for example, subdermally, within the liver, or intramuscularly. For some immune responses permanent sequestration from the host system may not be necessary. The electroprocessed material can be designed to shield the implanted material for a given length of time and then begin to breakdown. In still other embodiments, bacteria or other microbial agents engineered to manufacture the desired compound can be used. This embodiment provides the advantages of using cells that are more easily manipulated than cells from the recipient or a donor. Again, the electroprocessed material can serve to shield the bacteria from immune response in this embodiment. The advantage of using a bacteria carrier is that these microbes are more easily manipulated to express a wide variety of products. Embodiments in which cells are transiently transfected allow for expression to be limited to a defined period. Transient

genetic engineering allows cells to revert to their original state in embodiments in which such reversion is desired to minimize the risks of complications.

In some embodiments, cells are genetically engineered such that the expression of a specific gene may be promoted or inhibited through various means known in the art. For example, a tetracycline sensitive promoter can be engineered into a gene sequence. That sequence is not expressed until the tetracycline is present. Cell markers or bacterial markers can also be used to identify the inserted material. For example, green fluorescent proteins placed within an engineered genetic material glow green when expressed. Embodiments using this feature allow verification of the viability of the cells, bacteria, or gene sequences in a matrix. The visibility of such a marker also assists in recovering an implanted electroprocessed composition.

Although the present invention provides versatility in release kinetics, embodiments also exist in which one or more substances are not released at all from the electroprocessed material. Substances may perform a function at a desired site. For example, in some embodiments, antibodies for a specific molecule are immobilized on an electroprocessed matrix and the composition is placed at a desired site. In this embodiment, the antibodies acts to bind the molecules in the vicinity of the composition. This embodiment is useful for isolating molecules that bind to an antibody. Another example is an electroprocessed matrix containing immobilized substrates that will bind irreversibly to an undesirable enzyme and thereby inactivate the enzyme.

The compositions of the present invention may be combined with pharmaceutically or cosmetically acceptable carriers and administered as compositions *in vitro* or *in vivo*. Forms of administration include but are not limited to injections, solutions, creams, gels, implants, pumps, ointments, emulsions, suspensions, microspheres, particles, microparticles, nanoparticles, liposomes, pastes, patches, tablets, transdermal delivery devices, sprays, aerosols, or other means familiar to one of ordinary skill in the art. Such pharmaceutically or cosmetically acceptable carriers are commonly known to one of ordinary skill in the art. Pharmaceutical formulations of the present invention can be prepared by procedures known in the art using well known and readily available ingredients. For example, the compounds can be formulated with common excipients, diluents, or carriers, and formed into tablets, capsules, suspensions, powders, and the like. Examples of excipients, diluents, and carriers that are